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ABSTRACT

When planning or assessing formal scientific and technical information (STI) systems for research and development (R&D) laboratories, it is distorting and unhelpful to think in terms of "users" and "non-users." It is accurate and helpful to think in terms of services to informal groups--groups composed of both direct and indirect users. These informal groups have been shown to be extremely effective information pools that gain access to formal information systems by way of a very few group members who serve as gatekeepers. Therefore, instead of the number of direct information system users, other features of the R&D laboratory must be used as indicators of information needs that formal systems and services can meet. Some of these are: the functional arrangement of the laboratory's departments, the location of the laboratory within its parent organization, the stability of the organization's R&D goals, and the rate of scientific and technological change within the industry. In the short run, fine-tuning the formal STI systems and services in terms of these information need indicators may require the assistance of interpreters who are knowledgeable about the R&D process. (Author/PF)

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Overcoming the Non-User Nonsense and Other Fallacies: A Basis for the Design of Formal STI Subsystems

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Overcoming the Non-User Nonsense and Other Fallacies: A Basis for the Design of Formal STI Subsystems[1]

by

Patrick Kelly

I. Introduction

Before Jimmy Carter began attracting attention, the best known former governor of my home State of Georgia was Lester Maddox. In addition to the antics for which he gained national notoriety, Lester had something of a local reputation for his unusual insights. In one of these more reflective moments he is reported to have said that we couldn't really expect any substantial improvement in the State's prison system until we got a better quality prisoner. I am not sure just why this remark strikes people as funny, but it does. Perhaps it is because, with an unintended irony, Lester has expressed a sense of frustration with which people can identify -- a frustration in the failure of our best efforts to make any difference in the functioning of a complex system.

I sense something of the same frustration among the able professionals who design and operate formal scientific and technical information systems and services. With diligence, imagination, and no small commitment of resources, these systems have over the years become progressively more elegant and sophisticated.

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By every measure there has been impressive progress -- every measure, that is, except the number of users. At least in the R&D laboratory context, which is my focus today, each enhancement of search capability, each time-saving increment, each surge in comprehensiveness, is greeted by the potential users with about the same measure of indifference. What is the matter with these yoyos anyway? Relevant and timely information is the very lifeblood of R&D; so how can they possibly act this way and still survive?

But not only does R&D survive, it obviously thrives. This apparent lack of need is even more frustrating than the demonstrated lack of use. Even if Lester's recalcitrant inmates don't take advantage of the prison system's rehabilitating services, they need them and don't fare well without them, as the high recidivism rate clearly shows. But the researchers in the R&D laboratory show no signs of the sort of informational malnutrition that would result from unmet STI needs. They show only a rosy glow of informational good health and an obstinate indifference to formal STI systems and services. It's almost enough to make one agree with Lester's systemic point, i.e., significant improvements in the effectiveness of the formal systems and services must await a better quality -- or at least more receptive -- researcher.

But non-users, like prisoners, are not apt to change all that much. So before we yield to this dead-end conclusion, we should look a bit more closely at the behavior of these researchers

who seem not to need you, on the one hand, and at some of the assumptions that may shape your expectations about them on the other. This "looking at them" and "looking at you" -- in an iterative fashion -- constitutes the broad outline of this paper.

II. Anticipating Some Practical Conclusions

Before getting down to the details of the formal/informal systems interface, it might be helpful to anticipate some of the practical conclusions that we will be trying to persuade you to accept.

1. It is distorting and unhelpful to think in terms of "users" and "non-users."

The possible reasons for non-use of the formal STI systems and services are numerous, and most of them are quite sensible and unlikely to change. Furthermore, these reasons for non-use constitute no indictment of the formal systems or the non-users: you are not negligent and they are not slothful. In aggregate, most of the information needs in the R&D laboratory either can't be met at all by the formal systems and services, or they can be met better, quicker, and with significant social-psychological payoff by the informal system. The designation "non-user" distorts these realities by its implication that if only the formal systems or "those ninnies" were somehow different, then they too would become users. We know of no evidence to support this contention, however. Thus, the user/non-user way of thinking about the problem introduces a distorting dichcotomy that cannot yield much understanding of formal/informal systems interface.

It is also a very unhelpful distinction when used -- as it often is -- to gauge the value of formal STI systems and services. The evidence indicates that the number of users is going to remain a very small fraction of the total number of researchers. Therefore, if you judge the value of your service by counting noses you are asking for the systemic frustration Lester noted. No matter what you do, the nose-count is not going to get much better -- they simply can't use your good services at all, or have a better deal. There is an even more unhelpful implication than your continued frustration, however. If you make the number of users the bottom line in evaluating what you offer, then that same yardstick is going to be picked up and used by those who pay the bills. In a crunch, that may spell budgetary disaster; and even if it doesn't, it is a serious misrepresentation of the value of the formal STI systems and services.

2. It is accurate and helpful to think in terms of service to informal groups -- groups composed of both direct and indirect users.

We will try to persuade you that the market for what you offer is composed, not of isolated individuals, but of highly interactive informal groups. These informal groups have been shown to be extremely effective information pools. Accretions to these informal pools from external sources, such as the formal STI systems and services, are typically by way of a very few group members. Allen has called these individuals "gatekeepers." For present purposes, we prefer the term "direct users," since it serves to highlight the fact that these individuals, in turn, serve their informal group, thus making their colleagues "indirect users."

This notion of direct and indirect users is really a very simple one. Just as far more people eat food than go grocery shopping, just so do far more researchers benefit from the formal STI systems and services than use them directly. It is also a helpful picture, for it calls attention to the overlapping nature of the boundaries between formal and informal STI systems. Once it is recognized that the formal systems serve groups, through the few direct users, then it becomes clear that the effective boundaries of such formal systems are indeed quite large. Indirect users are users nonetheless -- a point which has been, but should not be, neglected.

3. There are features of the R&D laboratory and its environment that can serve as "indicators" of information needs that the formal systems and services can meet.

We will try to convince you that certain characteristics of the R&D context can be expected to exert systematic and predictable influences on the kinds of information required. These information need indicators would seem to offer the potential for "fine-tuning" formal STI systems and services to meet more adequately the needs of R&D laboratories and groups within them. A caution is in order, however. The kinds of questions about information use in the R&D laboratory that have led us to posit these indicators have not all been directly addressed in the research literature. Thus the evidence for some of them is, at this point, largely indirect. We are convinced, however, that the approach is a fruitful one, and that the indicators we describe could prove useful. The needed acid tests, however, are careful

empirical research by academics on the one hand, and their actual use by formal systems designers and operators on the other. I will be trying to persuade you to consider the latter, or use-test.

4. At least in the short-run, fine-tuning the formal STI systems and services in terms of the "information need indicators" may require the assistance of "interpreters," i.e., those knowledgable about the R&D process.

At the present time, the formal STI systems you represent and the informal systems of the R&D laboratory are largely independent mechanisms, interacting in unplanned ways that are often a puzzle. Ideally, however, they should function as interdependent subsystems of a larger whole. My use of the term "subsystems" in the title of this paper has reference to this better and much needed state of affairs. The initiative in designing and implementing this larger STI system -- which would embrace both the formal and informal as interlocking components -- must come from you. The reason is obvious. The informal systems, while enduring and extremely effective, are by their very nature the unplanned and mute creatures of past and present need, who constrain the future but cannot design for it.

The question, then, is how can you design this better integrated system? The answer is that you must do so by fine-tuning your formal component to mesh with the informal, which simply exists, cannot be designed, and cannot speak for itself. To get beyond blind trial and error in this fine-tuning process, I think it would be to your advantage to seek the assistance of those who might be able to "speak for" the informal component. There are those who are knowledgeable about the broader dimensions of the R&D process, the nature and function of informal laboratory groups, and the

patterns of STI flow within and among them. Such individuals could play an important interpreter role in working out a more effective interface between the formal and informal STI systems.

* * *

Having heard some of the more practical conclusions to be drawn from our investigations, I hope you are now sufficiently convinced, interested, puzzled, or perhaps angry to "hang in there" while I sketch out the analyses on which these conclusions rest.

III. The Nature of the Informal System

1. Informal Groups

An R&D laboratory's informal STI system is, in reality, a network of subsystems, or smaller informal groups, that are linked in various ways to one another, to the parent organization, and to the outside world. Figure 1 shows the informal system linkages in a typical functional department of a large R&D laboratory. Figure 2, by means of a graph-theoretic reduction, highlights the informal groups within this department. In the study by Allen (1970) from which these figures were taken, there were eight such departments of about fifty researchers each, and a median of three non-trivial (more than two members) informal groups per department. Within these groups the linkages are numerous and strong from frequent use. Between groups they are weaker, occasionally as tenuous as an infrequent contact between only two of a large number of individuals. Thus the flow of information is not uniform throughout the departments or the laboratory.

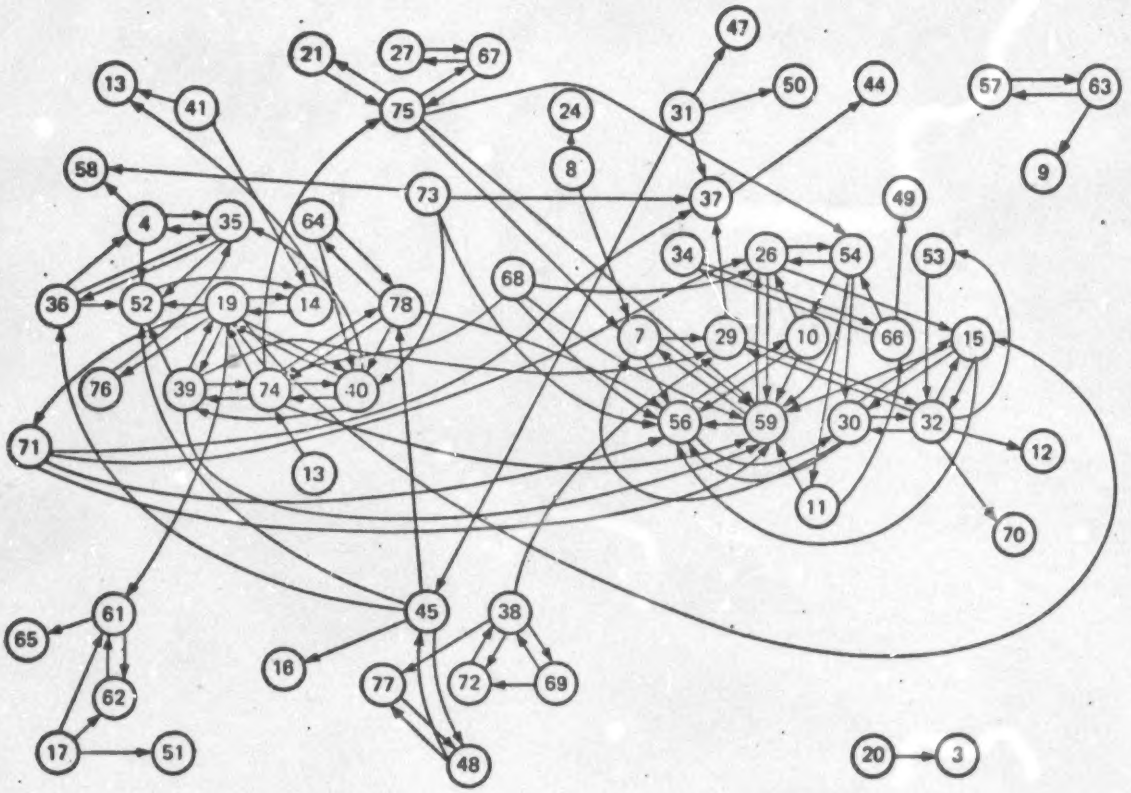

Figure 1
Communication Network of a Typical Functional Department of a Large R&D Laboratory (Allen 1970, p. 199).

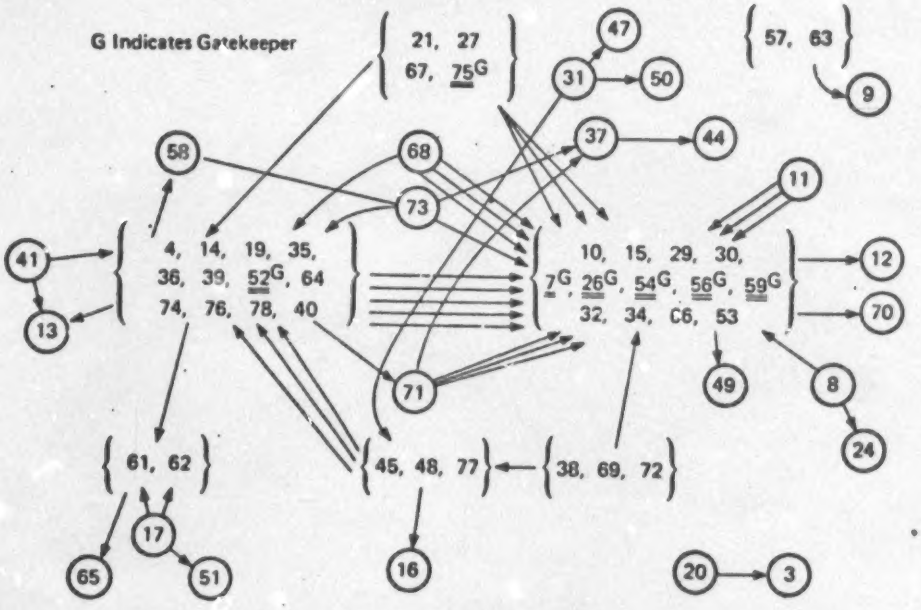

Figure 2
Departmental Communication Network After Reduction into Strong Components. (Strong Components are shown in brackets, and gatekeepers are shown by underlining with "G" superscript). (Allen 1970, p. 200).

These small, informal groups are created and sustained by the mutual social choices of their members. The reasons for such choices seem to involve the satisfaction of such individual needs as socialization, communication, and a greater measure of control over one's environment (see for instance Bernard 1938). Efforts to satisfy such needs by participation in informal laboratory groups are well illustrated in the R&D literature. We have restricted our investigations to these R&D-specific studies, plus such selective treatment of the broader social-psychological literature base as was required.

There is impressive evidence that the role of informal, mutual-choice groups in the laboratory is a very substantial, and, at times, a crucial one. In quite general terms, several dimensions of this role may be summarized as follows:

1. As highly interactive clusters in the laboratory's informal communications network, they seem to be the key to the storage and transfer, not only of scientific and technical information, but of market- and organization-need information as well;
2. They seem to constitute a substantial sounding-board, and even filter, for the researcher's perception of the "relevance" of his ideas and the reception they might be expected to get from management;
3. They seem to play an important "social-reality-testing" role in the assessment of technological alternatives that are not physically testable;
4. They are the facilitating mechanism in terms of which the benefits from key individual roles (gate-keepers, liaisons, supervisors) are made widely available within the organization; and finally,
5. They may greatly facilitate or inhibit cooperation across organizational boundaries, both within the laboratory and beyond.

Informal groups within the laboratory are not all alike, nor do they all perform these several functions in the same manner, to the same extent, or with the same effect.

In order to identify the reasons for some of these differences, we need to describe in somewhat more detail the main topographical features of the informal system, and the smaller informal groups that constitute its catalytic agents. To do this, let us assume for a moment a hypothetical laboratory, organized as follows:
1) It has separate, permanent department for the conduct of basic research, for design and development, and for analysis and testing;[2]
2) Each of these functionally-defined departments is, in turn, subdivided into discipline-oriented sub units. The point of this assumption is that, as Conrath (1968) has noted, "The very existence of a formal organization provides the raison d'etre for the formation of informal interest groups." From the perspective of the individual researcher, the point here is that the ways in which his needs for socialization, communication, and a greater measure of control are manifested, are greatly influenced by the nature and function the formal organizational units of which he is a part. The formal groupings not only focus his attention and effort, but also bring him into close contact with others who are similarly focused.

The particular laboratory structure we have assumed provides a doubly cohesive basis for the emergence and functioning of

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[2] R&D process phases (or functions) are defined and designated variously by both scholars and R&D organizations. We wanted to assume a functional or "phase-dominant" organizational form here, but the particular "benchmarks" we have chosen (and our labels for them) do not effect the point at issue, which is that; whatever the functional distinctions in terms of which R&D efforts are organized, formal groups are thereby created and the members of each group thereby share a common orientation, common goals and common problems.

informal groups. First, since the laboratory has a separate department for the conduct of each R&D function, distinctive formal groups are thereby recognized. These formal groups share a common set of goals, and common problems. Second, having the internal structure of each department reflect the researcher's professional field or discipline results in smaller formal groups that are even more cohesive. The members of these sub-units not only have a particular R&D function in common, but also share their distinctive disciplinary paradigms, coding schemes, expertise, etc.

Given this doubly cohesive formal structure, we should expect the informal groups that emerge within it to be quite strong and persistent information transfer networks. A number of studies have shown this to be the case.

It has been shown, for instance, that informal groups will be quite persistent in maintaining themselves in the face of organizational barriers. In addition to a laboratory's permanent structure, there are often established ad hoc work groups along either disciplinary or multi-disciplinary project lines. Given their ad hoc nature, it is quite possible that the composition of such work groups will not reflect the composition of the laboratory's informal groups. One's normal technical discussion partners may thus be assigned to some other work group for a period of time. It has been shown (Allen and Cohen 1966) that in such situations there is a strong tendency to continue to seek out one's informal group partners for technical discussion.

This conclusion finds additional support -- and also an important extension -- in a recent study by Taylor and Utterback (1975). They found that if the work group assignment involves a substantially different technical area, then, grudgingly, the old informal ties will break down, and new ones will ultimately emerge. In this case, the substantially different technical area apparently makes the old informal group less able to serve the new information needs. "Although the new assignment was in the same general technical field as before, a new set of contacts and information sources had to be developed. That the extent of disruption of existing patterns was not as great as expected, may be a result of the tenacity of habitual behavior..." (Taylor and Utterback 1975, p. 83). This tenacity we would read as reflecting the social-psychological importance of the informal group.

This reading is reinforced if one looks at multi-disciplinary project groups. The members of these ad hoc groups are drawn from different areas of specialization and thus lack the common bond of similar technical backgrounds. They do, however, have in common the new activity in which they are jointly engaged. This does not seem to be a sufficient basis for much informal information transfer. Taylor and Utterback (1975) collected data on the information flow patterns for four such project groups before, immediately after, and again 18 months after their formation. The combined results of this study are shown in Table 1.

TABLE 1

Comparison of Communication Frequencies for Members of Project Groups Prior to, Immediately After, and 18 Months After Their Formation

	Prior to Project Group Assignment	Immediately Following Project Group Assignment	18 Months After Project Group Assignment
% of Project Group Professionals Above the Laboratory Median in Technical Discussion Choices Within their work group.	25.0%	0.0%	0.0%

(Taylor and Utterback 1975, p. 85)

Not only did these project groups not develop significant in-group technical communication patterns even after 18 months together, but as the investigators noted, there was, if anything, even less communication at the time of the final measurement. The researchers in these groups did not suffer from "informational malnutrition," however. They continued to seek out members of their respective informal groups for technical discussion.

Thus there is evidence from a number of contexts to suggest that the patterns of STI flow within formal laboratory groups are not uniform throughout. Rather, the informal communication networks they embrace are characterized by highly persistent, interactive clusters linked to one another by relatively far fewer and more infrequently-used channels. These clusters or informal groups we take to be the heart of the informal STI system.

2. Within the Informal Group: the Gatekeeper Role

To round out this picture of the laboratory's informal system, we would need to examine several key individual roles -- the gatekeeper, the liaison, and the supervisor. Time will permit us to look at only one -- that of the gatekeeper.

Just as information does not flow uniformly within the formal laboratory groups, but is concentrated within highly interactive informal groupings, so too is this pattern to be found within the informal groups. For whatever reasons -- peculiarities of technical background, social-psychological idiosyncracies, etc. -- it turns out that individual researchers differ significantly in the extent to which they utilize information sources beyond their own group, and consequently, in the extent to which they are sought out for technical discussion by others of their group. Allen (1964, 1966, 1969a, 1969b, 1970) has used the term "gatekeeper" to refer to those individuals who specialize either in the formal literature or in informal information sources beyond the organization. In addition to a much higher than average usage of one of these channels to the outside, these gatekeeper individuals are also the technical discussion "stars" of their groups. That is to say, because of the information they possess these individuals are much more frequently sought out for technical discussion by their colleagues than others in the group.

In addition to his central position in the informal group's communication network, the gatekeeper also makes significant direct contributions to the laboratory's technical mission. He compares quite favorably with other professionals in the laboratory on a variety of performance measures. In addition, a significant number of first and even second-level supervisors have been identified as gatekeepers (Allen 1970, p. 197). Thus these individuals are key people in terms of productivity as well as STI transfer.

Taylor and Utterback (1975), in their longitudinal study of work groups assigned to new and significantly different technical areas, have noted another important feature of the gatekeeper "profile". The members of the disciplinary ad hoc groups with changed technical assignments who had previously functioned as gatekeepers could not do so, of course, immediately after their reassignment. New sets of contacts and information sources had to be developed. Eighteen months after the new assignment was made, however, those who had functioned as gatekeepers before had reemerged to play this role again. Thus it would seem as if the ability to serve as a gatekeeper depends more on psychological or social-psychological characteristics than on the particular circumstances of the work situation.

A final point about gatekeepers concerns their contact with one another. In the large R&D departments Allen studied, while a total of twenty-one informal groups were identified, 64 per cent of all the gatekeepers were in eight of these, one for each of the fine engineering and three science sub-groups. Thus in each disciplinary sub-unit there was one informal group that included most of the gatekeepers (Allen 1970). The gatekeepers,

therefore, seem to maintain close contact with one another, in addition to their high level of interaction with the indirect users they serve.

> Time constraints dictate that we simply end our topographical sketch of the informal STI system at this point.

IV. Information Need Indicator

With this characterization of the informal STI system before us, we may now ask about conditions in the laboratory and its larger environment that may systematically influence information flow phenomena and thus come to serve as information need indicators. The conditions we will here consider are shown on the next slide.

1. The several R&D functions;
2. Functional vs. Project-Oriented Laboratories;
3. Corporate vs. Operating Division Laboratories;
4. Stable vs. Frequently-Changing R&D Missions;
5. The Rate of Scientific and Technological Change within the Industry;
6. Incremental vs. Discontinuous Innovative Efforts.

1. The Several R&D Functions

In the sketch of the informal STI system offered above, our hypothetical laboratory had permanent departments for the conduct of basic research, design and development, and analysis and testing. This scenerio now needs to be refined in terms of the differences inherent in these several R&D functions. It is helpful in this regard to think of these functions as arrayed along an even larger continuum which has the generation of new

knowledge for its own sake as one pole, and the actual production of artefacts or services as the other. The basic research function within R&D lies closest to the academic end of this spectrum, and what we have here labelled analysis and testing, lies nearest the production or operations pole. The "information-need" implications of these positions are fairly straight-forward. Those in basic research, while not as free to pursue knowledge for knowledge's sake as their stereotypical counterparts in academia, are less constrained by operational realities than those who perform the later functions. By the same token, the information needed in their work is less likely to exist in-house. Thus, basic research is much more dependent on external sources of information than the other R&D functions. This is not to say, however, that they are necessarily more heavily dependent upon gatekeepers. Those involved in basic research may well be so dependent on external information sources -- and so well connected with both the literature and their professions' "invisible colleges" -- that they may not need gatekeepers all that much. That is to say, at the basic research end of the spectrum most researchers may be gatekeepers rather than only a few.

At the other end of the spectrum, where R&D interfaces with operations, the information-need picture is quite different. Here the work is so closely tied to operational needs and constraints -- and to the marketplace -- as to typically require little STI from the outside. In-house information is so dominant in this late R&D phase that the need for gatekeepers is probably also minimal.

Finally, between these extremes -- where the need for the formal STI systems, or the lack of it, is clear-cut -- we find a mixed state of affairs. This middle ground, that we have called design and development, is both more constrained by organizational or mission necessity than basic research, and more sensitive to the state of the technical art than the later analysis and testing phase. Just where the balance between in-house and external STI is struck in the conduct of this function -- and thus just how important the formal systems are to it -- depends on other characteristics of the particular situation and cannot be determined by this single indicator. Examples of this balance being tipped sharply in one direction or the other will be offered in a moment.

2. Functional vs. Project-Oriented Laboratories

Thus far, our analysis has been restricted to laboratories organized by R&D function. It is also common, however, to find a "project-dominant" arrangement, i.e., multi-disciplinary units that work on long-term projects or service major product areas. Such units are responsible for the whole spectrum of R&D functions, from basic research to the interface with operations. Given their multi-disciplinary make-up, such units afford only a single basis for informal group cohesion -- the project itself. As a result, the empirical evidence to date would lead one to believe that the informal STI system under this structure would be weaker, and thus the need for formal services greater. This is not to argue that any one organizational arrangement is the best overall -- there are many relevant considerations other than informal system efficiency. It is to say, however, that departures from the R&D

function/professional field structure outlined earlier are probably made at some cost in the quality of the informal system, and thus that organizational structure may be an indicator of the extent to which formal systems and services are needed.

A brief example is in order. A group of researchers accustomed to carrying a project through all its phases will presumably not have the highly specific knowledge or contacts of those who specialize in a single phase. For instance, their basic research effort on a new project will probably involve a less informed and lengthier search of the literature. Their in-house informal groups, because of the nature of this formal structure, are more likely to be in this same "early learning" boat, and thus of less help than the informal groups under the functional structure described above. Because much of their time has been spent in areas other than basic research, these researchers probably also have fewer invisible college contacts to turn to. For these reasons, their dependence on STI system and service professionals would seem to be much greater. If we were to track the information needs of such a project-dominant group through the subsequent R&D phases, the picture would be similar, except that their relative informational deficiencies should show a progressive shift toward in-house STI as they approached the operations-interface end of the spectrum.

3. Corporate vs. Operating Division Laboratories

A third characteristic of the R&D laboratory, which may serve as an indicator of information need for the formal system designer,

involves the location of the laboratory within its parent organization. As is shown by figure 3, central laboratories exhibit a much greater reliance on external sources of information than do operating division laboratories, for all of the R&D functions. For the sake of time, we will not go into the reasons for these differences. They are analyzed in an outstanding study by Rosenbloom and Wolek, Technology and Information Transfer (1970) which I highly recommend. Suffice it to say here that this distinction between the central and operating division laboratory seems to constitute a useful inciator for formal systems design.

4. Stable vs. Frequently Changing R&D Missions

The contrast we have in mind here is a simple one, at least in the extreme cases. On the one hand, consider the organization whose laboratory, production facilities, and marketing force are wholly committed to a single product line. On the other, consider the organization with a laboratory, but no production facilities, whose product is R&D itself. It is reasonable to expect that the latter, the R&D contract organization, is going to have the greater, continuing need for the formal STI systems and services. No matter how technically able its laboratory personnel, the frequent and substantial shifts in R&D focus with which they must deal assures that the in-house information pool will often be inadequate.

The contrast between the stable and the frequently changing R&D missions is often not as clear and sharp as we have drawn it here. The single product-line organization and the R&D contract shop do, however, constitute fairly unambiguous opposite poles

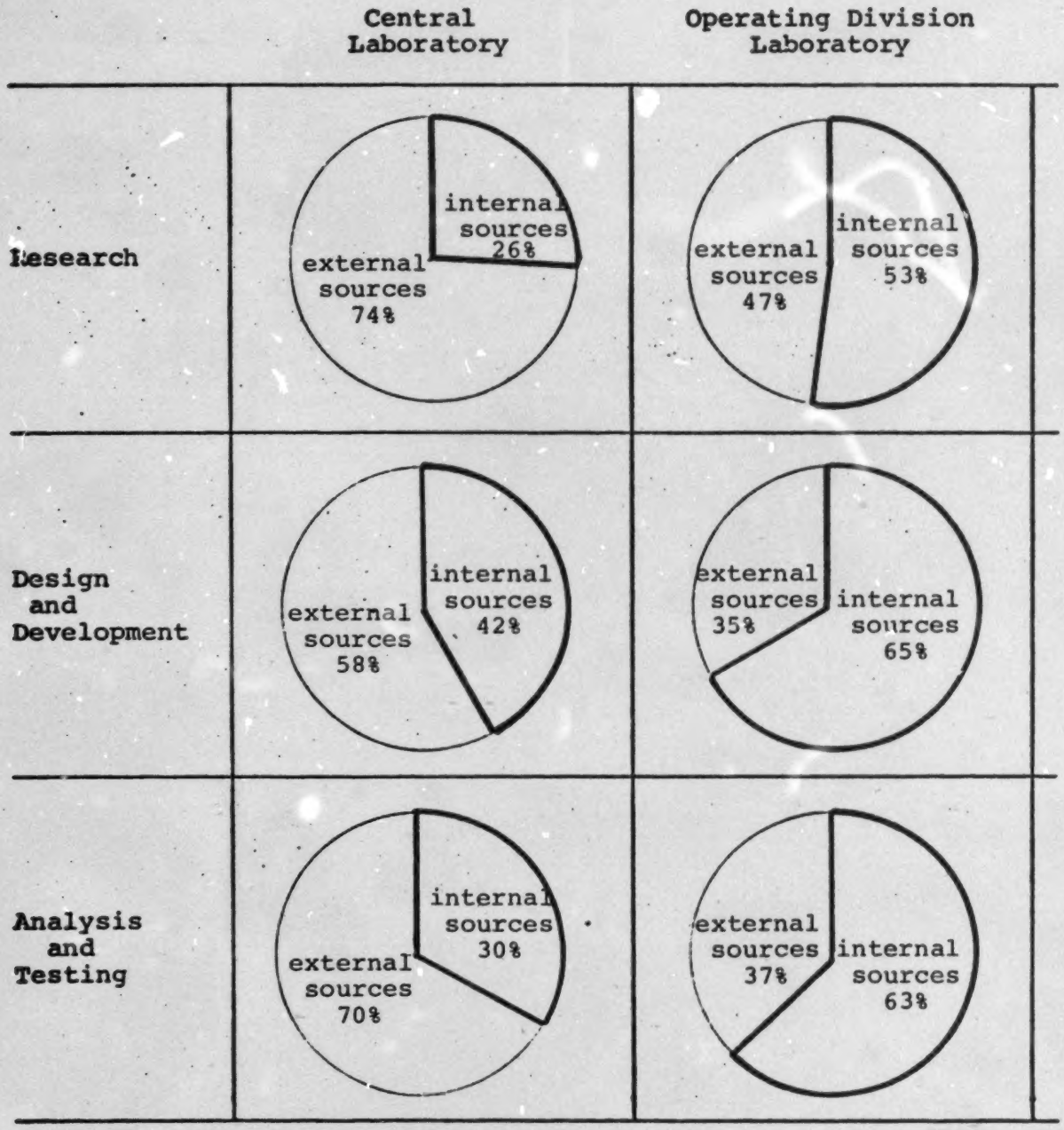

Figure 3

Comparison of External vs. Internal Information Source Usage by Fundamental Groups in Central and Operating Division R&D Laboratories (From Rosenbloom and Wolek 1970, pp. 49-50).

from which to begin an analysis of the influence of this information need indicator. As with all of the indicators we are suggesting, as you move away from the clear influence of a polar case there is a corresponding increase in the need for a multivariate analysis -- i.e., a need to compare and constrast the influence of this indicator with the influence of others.

5. The Rate of Scientific and Technological Change Within the Industry

This indicator of the need for external information, like the previous one, has to do with the relative adequacy of the in-house information pool. Here, however, we are concerned with the pace at which the state of the art knowledge is changing rather than the frequency of organizationally-induced shifts in the laboratory mission.

The basic hypothesis here is as straightforward as in the previous cases: the higher the rate of scientific and/or technological change in the industry of which the laboratory's parent organization is a part, the greater the need for the formal systems and services. Even for the extremely high rate of change industries, such as electronics or ethical drugs, it should be remembered, however, that the number of direct users will be but a small percentage of the total researcher population. Even here you will continue to serve most indirectly, i.e., though their informal groups. Nevertheless, the high technology industries should be expected to need your services more than their more slowly changing counterparts. The rate of change may thus serve as an indicator for the design and fine-tuning of your systems.

6. Incremental vs. Discontinuous Innovative Efforts

The final information need indicator we would mention lies, not in the conditions within the laboratory or its larger environment, but in the magnitude of the innovative effort itself. At one extreme, an innovative effort represents a minor extension on what the organization is already producing -- a small increment or next step. On the other hand, it may constitute a radical departure -- a discontinuity if you will. Most of the information required for the former, or incremental improvement effort, typically exists as a part of the in-house pool, and little is demanded of external information sources. The matter is quite otherwise for discontinuous efforts, however. Massive infusions of information from the outside will likely be required -- and in a new area where the organizations' gatekeepers may not be "on top of things."

Thus if it can be anticipated that an organization -- for either defensive or offensive purposes -- is preparing to depart from the typical incremental improvement mode of R&D, this represents an unusual opportunity for the formal systems and services. As before, it is an information need indicator around which the formal system can be fine-tuned.

* * *

This concludes our half-dozen sketches of conditions that might serve as need indicators for the design or fine-tuning of the formal STI systems and services. If you think this approach bears promise, I would be pleased. If you think it provides ready-made answers that you can go home and use, however I would

suggest that your conclusion is premature. While I think the approach is sound and the indicators I have discussed are at least among the useful ones, a very large problem remains. These several conditions do not impinge upon the laboratory, and influence the nature of its information needs, in grand isolation from one another, but in combination -- in fact, in many possible combinations. Thus, the influence of any one is but a fun puzzle for academics. But you don't deal in puzzles, you deal in problems, real, live, jumbled, ambiguous problems. And the question is, how good are these neat indicators when they are taken in concert? When they bang together in an actual laboratory situtior, which ones override, and which are overriden? Which ones simply cancel each other's signals, and which ones create a clear direction that you can follow?

If I had some simple answers that you could act on without further ado, I would have begun with them and we could have retired to the bar by now. I have no such simple answers, but would like to suggest a reasonable next step.

V. The Need for "Interpreters" in the Design and Fine-Tuning of Formal STI Systems and Services

The last of the four conclusions that I urged on you at the beginning of this paper was that;

> At least in the short-run, fine-tuning the formal STI systems and services in terms of these "information need indicators" may require the assistance of interpreters who are knowledgable about the R&D process.

Such interpreters, who could speak for the mute but powerful informal system, just might be able to work with you in the process

of learning to read the information need indicators as they exist in concert. If you got together with such interpreters of the informal system, and all of you were patient enough with one another's early learning struggles, you just might be able to realize significant progress -- progress toward the realization of a larger systemic whole of which the formal and informal were truly interdependent subsystems.

VI. A Final Word

If I have persuaded you that it is at least unhelpful -- if not outright nonsense -- to talk about users and non-users, then I am pleased, for otherwise you sell your own work short; worse yet, you sell the formal systems short.

If I have persuaded you that you serve groups, then I am again pleased, for otherwise you sell the informal systems short.

If I have persuaded you that information need indicators are more than figments of my imagination -- that they exist and that together we might learn to read them, then I am more than pleased, I am delighted, for the search for them is a search for more meaningful interdependence.

Finally, if I have persuaded you that interpreters -- spokes-persons for the mute informal systems -- just might be a helpful next step, then I am truly grateful, for the dialog can begin.

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